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Mr. Latimer Clark, C.E.

A

Sketch of his Life and Work.

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MR. LATIMER CLARK, C.E.

By H. T. HUMPHREYS, Trinity Coll., Dublin.

AMONG the workers of the present century who have contributed to the growth and development of practical science, rendering some of its greatest and most difficult problems matters of mere routine, there are few more deserving of note than Mr. Latimer Clark, C.E., whose triumphs in mechanical, and especially in electrical, engineering have gained for him a prominent position in the history of the practical application of science to human progress.

Mr. Latimer Clark was born at Great Marlow, in Buckinghamshire, on the 10th of March, 1822, and in the year 1847 he commenced railway surveying, and his brother, Mr. Edwin Clark, who had been engaged in making a number of experiments preliminary to the construction of the Britannia Tubular Bridge across the Menai Strait, having been appointed Superintending Engineer of this great work, Mr. Latimer Clark became his Assistant-Engineer, and as the work was too novel and important to be undertaken by contract, he had the practical management of all the details, including the hiring, control, and settlement of wages of all the workmen employed on the whole structure from the first commencement of the iron work to the final floating and raising of the tubes. During the lifting of the first tube of this bridge, which was accomplished by means of hydraulic presses, Mr. Edwin Clark was on the top of the cross head of one of these presses watching the motion of guide rods, when a huge fragment some three tons in weight suddenly burst from the bottom of it, and the tube fell suddenly on to the timber packing on which it had rested before the press had been set to work. Mr. Edwin Clark fell into the

tower above and was not much hurt, and Mr. Latimer Clark who was actually standing underneath the press miraculously escaped being crushed by the falling mass. As the ponderous ram and chains, weighing ninety tons, descended, Mr. Clark's body was compressed into a narrow recess in the iron which shielded him from injury, but buttons and portions of his clothing were flattened to the thinness of gold leaf. This accident caused a delay of some six weeks, for the tube required extensive repairs, and a new hydraulic press had to be obtained ere the work could be proceeded with. Mr. Latimer Clark afterwards published a small work entitled a description of the Britannia and Conway Tubular Bridges which has run through several editions and indeed has been extensively sold as a guide book for visitors who desire to spend a few hours in examining this triumph of engineering science and skill.

During the sojourn of Mr. Latimer Clark at Menai Bridge while engaged on this work, he used regularly every evening to discharge at 8 o'clock a time gun, fired by electricity, and this circumstance coming to the knowledge of Mr. J. L. Ricardo, Chairman of the Electric Telegraph Company, led him to become acquainted with the young engineer who, in 1850, entered the service of the Company as Assistant-Engineer, under his brother. He afterwards became their Engineer-in-Chief and Consulting Engineer, an office which he held until the General Post Office finally took over the telegraphs, in January, 1870. During this period he was actively engaged in the general work of the Company, but nevertheless found opportunities of directing his attention to the discovery of many important improvements in the telegraphic system, as well as to the invention of other contrivances more or less connected with the subject of the transmission of messages. In the year 1853 he made a long series of researches on the subject of the underground telegraph wires between London, Leeds, and Liverpool, the results of which were afterwards fully set forth in the Government Report, issued in 1861, on Submarine Telegraph Cables. In the course of the experiments he was the first to witness the retardation of electric signals in submarine lines, and to demonstrate that currents of low tension travel as fast as those of high tension. At the request of Professor Airy, the Astronomer Royal, some of these experiments were repeated before Professor Faraday, and formed the subject

of a lecture at the Royal Institution, delivered in January, 1854. They are fully described in Faraday's *Experimental Researches*. In the year 1856 Clark invented and patented the double-cup insulator for overland telegraph wires, the most perfect insulator known, and these double-cup insulators are now universally employed, not merely in this country, but wherever electric wires are carried overland. He also, at Professor Airy's request, assisted him in the simultaneous announcement of time throughout the country; he interested himself in magnetic research, and in 1857 was the means of affording the interesting information that during a display of Aurora Borealis the magnetic needles were strongly affected by the magnetic storm of which this northern light is a sign. He wrote to the Astronomer Royal suggesting that magnetic observatories should be furnished with wires stretching out towards the four cardinal points, to act as feelers for electric currents. This suggestion has since been acted upon with valuable results to science. To him also is due the suggestion to the Electric Telegraph Company to employ telegraph stamps in their business, a matter which proved of great convenience to the public.

During his brief intervals of leisure he amused himself with photography, and in 1853 devised a plan of obtaining stereoscopic pictures with a single camera. He was also the first operator who produced what is now well known as a "Vignette Photograph." These were described in the first volume of the *Photographic Journal*. Photography, however, cannot long be followed as a mere recreation, its pursuit speedily becomes absorbing, and where more important work requires our attention, it becomes dangerous to engage in so fascinating an occupation. Hence there remains little further to chronicle with regard to Mr. Latimer Clark's photographic investigation and discovery.

Meantime his attention was turned to another mode of securing the prompt despatch of messages, especially useful in popular centres, and this led to his invention in 1854 of the Pneumatic system of transmission, now so largely made use of in London as well as in other populous cities not only in England, but all over the world. In 1857 the Pneumatic Despatch Company was established, and Mr. Latimer Clark was appointed its engineer, in conjunction with Mr. Rammell. A tube, four feet six inches in diameter, was laid down between Euston Station and St. Martin's-le-

Grand, through which small waggons containing the mails were sent back and forward by means of the pressure of air. The mail bags were regularly transmitted by the Company for two years, but though the mechanical success of the plan was perfect, and its results were of great value as regarded the speed and security of mail delivery the project did not prove remunerative to the shareholders, and the whole system is now in the hands of the Post Office, being employed on a smaller scale for the transmission throughout the metropolis of what are erroneously, so far as they are specially concerned, classed as "telegraphic messages." This invention laid the foundation of the Pneumatic Railway enterprise.

He devoted much attention to the means of lengthening the lives of submarine cables which were found as a rule to become faulty and almost useless after having been laid down for from four to five years. After many carefully conducted experiments he, in the year 1858, invented a method of protecting these cables, covering them with Asphalte, Hemp, and Silica, now known to all persons connected with the manufacture of telegraph cables, as Clark's Compound. The result of the application of this covering is that cables now frequently last for twenty-five years. It was in this year that he became a Member of the Institution of Civil Engineers. In the succeeding year, after the failure of the first Atlantic cable, he became for a short time Engineer to the Atlantic Cable Telegraph Company, and in 1860 he was chosen a Member of the Committee appointed jointly by the Government and that Company to inquire into the whole subject of Submarine Telegraph Cables. This investigation lasted for some time, and resulted in the publication of an elaborate and valuable report of considerable extent, embodying all that up to the period of its issue was known with relation to submarine telegraphy. This volume from the clear and accurate account it gave of the causes of the failure of submarine cables, and especially of the first Atlantic telegraph, not merely reassured the public mind, but also gave a great stimulus to telegraph cable enterprise. In the compilation of this still valuable report, and in the experiments conducted on behalf of the Government Committee, Mr. Latimer Clark had an important share.

In 1861, with Sir Charles Bright, who was also at that time in partnership with him, Mr. Latimer Clark took the

initiative in calling attention to the very unsatisfactory and anomalous condition of Electrical science, as regarded the means of expressing the relative strength of various currents, &c., and to the necessity for the adoption of given fixed standards for Electrical measurements. He read a paper before the British Association in that year, "On the principles to be observed in forming standards of Electric Measurements." In this paper he suggested the names of Ohm, Farad, and Volt, to be employed for the Electrical units, names which have since become so familiar to Electricians. The result of this paper was that the British Asso-ation appointed a committee to consider the subject, which after careful examination into it eventually recommended the adoption of many of the suggestions in the paper, and this paper has in fact formed the basis of the now generally recognised system of Electrical nomenclature. Mr. Latimer Clark also for many years was engineer to the Indian Government Cable lines in the Persian Gulf. On one occasion the expedition of which he had charge was wrecked in the "Carnatic" on the Island of Shadwan in the Red Sea, and he narrowly escaped with his life; while under water he was crushed by the wreckage, his arm was dislocated, and he was so much injured that after gaining the shore with one hand, he remained for some hours insensible. As head of the firm of Clark, Forde & Co., and in connection with other engineers, he has superintended the submergence of some fifty thousand miles of submarine cables in all parts of the globe.

In 1863, in connection with Charles Bright, he entered upon a careful and prolonged series of experiments upon the effect of temperature on the insulation of gutta percha cables. By means of these important experiments they established the degrees of resistance at all temperatures which could affect submarine cables in use, and a set of tables, was published giving the resistance for the different temperatures, which has proved of the greatest value to all engineers engaged in submarine telegraphy, who have since its publication made constant use of it. In 1866 he was one of the party that sailed from Sheerness in the Great Eastern to see the shore end of the Atlantic cable laid at Foilhammerum point, Island of Valentia, Kerry. In the same year he made a number of experiments which attracted much attention among scientific men, upon the method of the formation of the condensers for Electric

cables now so extensively used in connection with the system of duplex work. In 1868 he published a work in which he laid down with great clearness the principles of Electric measurement, which was so much appreciated that it is now out of print and has become extremely scarce. It was translated into French, Italian, and Spanish, and eagerly perused by foreign *savants* whose idea of its value may be gathered from the fact that when some time afterwards Mr. Latimer Clark was in Paris and entered a scientific meeting then sitting, the President rose from his seat and hailing with delight the advent of their visitor, stated that he had never fully appreciated the laws of Electricity until he had read this work.

In 1871 he published, in conjunction with Mr. Robert Sabine, his "Electrical Tables and Formula for Operators in Submarine Cables," a work which is constantly in requisition and always in demand, being admittedly the standard book on the subject. In 1873 he read before the Royal Society a paper on "A Single Cell Battery as a Standard of Electro Motive Force," now in general use under the name of "Clark's Standard Cell." In 1875 he was elected the fourth President of the Society of Electric Telegraph Engineers, and in his inaugural address gave some highly interesting outlines of the harbingers, and even what might be called promonitions, of the electric telegraph, mentioning the idea of some old writers, that two magnetic needles would vibrate in unison at any distance apart, though unconnected the one with the other. He referred to the fact that a Scotchman, named Charles Marshall, or Morrison of Paisley, had in 1758 published a full and clear description of a practicable electric telegraph, suggesting that the wires should be coated with an insulating material; and he referred to the electric telegraph erected by the late Sir Francis Ronald, in the year 1816, in his garden at Hammersmith. He bore testimony to the remarkable foresight of Sir F. Ronalds with regard to the value of the telegraph, which, in 1823, he had proposed that the Government should establish all over the kingdom. The Government, however, snubbed him, and his invention shared the fate of many others, being before its time. Mr. Latimer Clark gave an interesting history of the development of the present telegraphic system, and turning then to the history of the Society, congratulated them on having become the depositories of the Ronalds' library of electrical

works, a most valuable collection, the deposit of which with the Society had been secured mainly by the efforts of Mr. Latimer Clark himself, who has also been engaged for many years in the collection of works of this class, and now possesses a magnificent library, including books in all languages treating of electricity, galvanism, and magnetism—from the "*Speculum Naturale*" of Vincentius, printed in 1473, and Neckam's "*De Naturis Rerum*," written in the twelfth century, and published a few years since—to the modern treatises and papers on these subjects. In concluding his address, the President recommended the Society to enlarge the signification of their title, so as to become the Society of Telegraph Engineers and Electricians, a suggestion which has since been adopted.

Mr. Latimer Clark has taken out about one hundred and fifty patents in different countries to secure the value of his various inventions, relating not only to electrical telegraphy, but also to engineering work in general. He called attention, as long ago as 1867, to the anomalies of the Birmingham wire gauge, which is of the most unsatisfactory character, the fact being that for general purposes no accurate wire gauge exists, as the sizes of numbers vary in thickness according to the manufacturers who send them out, each having his own arbitrary system of designating the different sizes which he sells. Mr. Latimer Clark has read papers on this subject in 1867, 1869, and again as recently as 1879. He has, however, at length succeeded in calling attention to the subject, and a Committee now has the matter in hand, which it is to be hoped will, ere long, be settled by the definite adoption of some fixed standard scale of measurement.

Besides the work specially connected with Electric Telegraphy, Mr. Latimer Clark has also been extensively engaged in other important engineering operations, and has contributed to no small extent to the progress of the century in the practical triumph of Science over difficulties. The Engineering firm of Clark & Standfield, which his brother, Mr. Edwin Clark, has since joined, has brought out some very important inventions, giving practical effect to scientific principles, in dealing with problems that hitherto have been looked upon as almost beyond the power of Engineering skill to solve. One of these is Clark & Standfield's patent floating docks, of which one of the largest completed was the Nicolaieff floating dock for the Emperor of Russia, a

description of which formed the subject of a paper read by Mr. Latimer Clark before the Institute of Naval Architects, at their seventeenth session, in April, 1876. The floating dock and gridiron consists of a number of pontoons placed parallel to each other, and fastened together by a bridge or platform running along one end of the pontoons. The maintenance of the dock which, looked at from the end is like the letter L, in its proper position in the water, is secured by means of a caisson attached by slanting rods to the platform before-mentioned. A ship being beside the dock, the valves in the pontoons are opened, and water is admitted till the dock is sunk beneath the vessel, which is readily brought into its proper position on the dock, and fixed there by means of a proper frame or cradle drawn in under it. The dock is then raised by pumping out water until it rises with the ship in its place above the surface of the water. The ship can then be taken to the side of a river or bay, and there deposited on a stage prepared so that its supports project at distances suited to allow the pontoons to pass in between the beams of the stage. The dock is lowered till the ship and cradle rest on the beams, when the dock is withdrawn and taken away to receive another ship to be deposited on a similar stage. The docks are so constructed as to receive large vessels, and can be separated into two, three, or more independent parts. The Nicolaieff floating dock is of unusual size, and has repeatedly raised the circular Popoffkas, which are too broad to be docked by any other dock in the world.

The firm are also now extensively engaged in designing monster lifts for canals, by means of which canal boats, instead of a tedious passage through a long series of locks, are now lifted floating in a tank to a height, if needful, of 70 feet, and turned into the water at the higher level, an operation requiring but three or four minutes, while an hour or two would be needed to take it to the higher level by the old fashioned locks. For this purpose they are employing in France, Belgium, Italy, &c., gigantic hydraulic presses nearly seven feet in diameter and with pistons more than 70 feet in length. One of these lifts, erected by Mr Edwin Clark in Cheshire, has been working most successfully for ten or twelve years.

One of the newest inventions brought out by Messrs Clark and Standfield is a new mode of raising sunken ships This has not yet been tried on a practical scale, but ex-

periments appear to demonstrate that it is the most effective plan yet proposed for such purposes. The details were explained not long since to a party of thoroughly competent listeners, by Mr. Latimer Clark in the diving pavilion at the Crystal Palace, where several experiments were tried with the sunken model of a ship, which certainly appeared to justify confident expectations of great success in carrying out the proposed scheme. In the first place, where the bulwarks of the sunken ship are sound, it is proposed to grip them by pumping air into air bags, and as they become filled with air they rise, carrying up the ship with them. Where, however, the bulwarks are not sufficiently strong, the plan is to place over the ship large camels with folding ends, with intervening air bags which press against the two sides of the ship, and in like manner grip and raise her. It was admitted by nautical men present that there would be no practical difficulty in lowering such camels over a ship into the proper position. The third plan was a highly ingenious adaptation to this purpose of the power of the electro-magnet to procure the means of temporarily attaching apparatus to the sides of a ship. The diver is furnished with a dynamo-electric machine enclosed in a hermetically sealed box connected with a similar machine above worked by a steam engine. The box containing the machine under water is adjusted to be of the same specific gravity as the water, so that the diver can move it about freely. He places this box against the side of an iron ship and by moving a switch, connects it with the working machine above. It at once becomes a powerful magnet and adheres to the side of the ship with a force equivalent to a pressure of four tons, while at the same moment the machine inside begins to revolve with great force, and the end next to the ship being armed with a drill in a minute or two pierces a hole in the side of the ship. The machine is then disconnected and removed to another spot where the process is repeated, and bolts having been screwed into the holes, air bags or other apparatus can be firmly attached to the ship. To facilitate the operations of the workman a magnetic stage, adjusted to the specific gravity of water, is also provided for him, which he can cause to adhere to the side of the ship by connecting it with the machine above, and can then stand or sit on it as may best suit his work.

By one or other of these plans it seems to be possible to get at ships sunken in almost all kinds of places, and when we consider the number of wrecks reported annually in close vicinity to our own coasts alone, it is obvious that the company which it is proposed to form, has a large sphere of action in which to labour with a good prospect of abundant remuneration. It must be remembered also that in a great many cases the value of the ship and cargo sunk is a mere bagatelle as compared with the mischief it may occasion by remaining in a channel, or in a direct line of navigation, and a company possessed of apparatus for the purpose might render essential service to the whole shipping and commercial interests of the country by promptly removing such obstructions. Hitherto the great difficulty with regard to sunken ships has been to pass underneath them chains of sufficient strength to bear their weight, but by these plans, chains are no longer needed. Of course, it is true, that as yet, experiments have only been made on a small scale; but we must remember, that the inventor of this plan is a man of long practical knowledge of engineering, and not likely to be mistaken as to the powers of his machinery, while it may also be worth recalling the fact, that the great tubular Britannia Bridge was erected on plans, and with such details of construction as were proved to be suited for it by experiments on a small scale.

It is curious to note how Mr. Latimer Clark has all his life been engaged in various branches of one great section of the progressive development of the age; this section being the constantly increasing facilities of commercial intercourse. We find him in the commencement of his career associated with the greatest work of the greatest engineer of the day, in taking railway trains with passengers and goods, across an arm of the sea. He next devotes himself to improvements in the speedy transmission of messages and letters, and is associated with the greatest telegraphic work of our time, the successful laying of a cable across the Atlantic. Again, we find in the floating-dock an invention of enormous practical value in diminishing the unproductive periods in the life of shipping, as in the canal-lift, the saving of time in the transmission of goods by boat. And in the last mentioned scheme for raising sunken ships; we have further development of the like progress as diminishing the amount of loss by shipwrecks. He must, therefore, be considered as one of the important, though unobtrusive

workers of the century, and one who certainly appears to have by no means wrapped up his talents in a napkin. With all his business engagements, and his devotion to practical science, he is by no means so buried in his professional pursuits as to be unable to enjoy society, in which his genial, pleasant manners, and his large fund of readily accessible information render him thoroughly popular. His memory, moreover, is good, and he is as little likely to forget as to neglect an acquaintance.

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